East Engin. Library

JAN 20 1944

FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 71. No. 1427. DECEMBER 23, 1943

Registered at the G.P.O. as a Newspaper. Offices: 49, Wellington Street, Strand, London, W.C.2

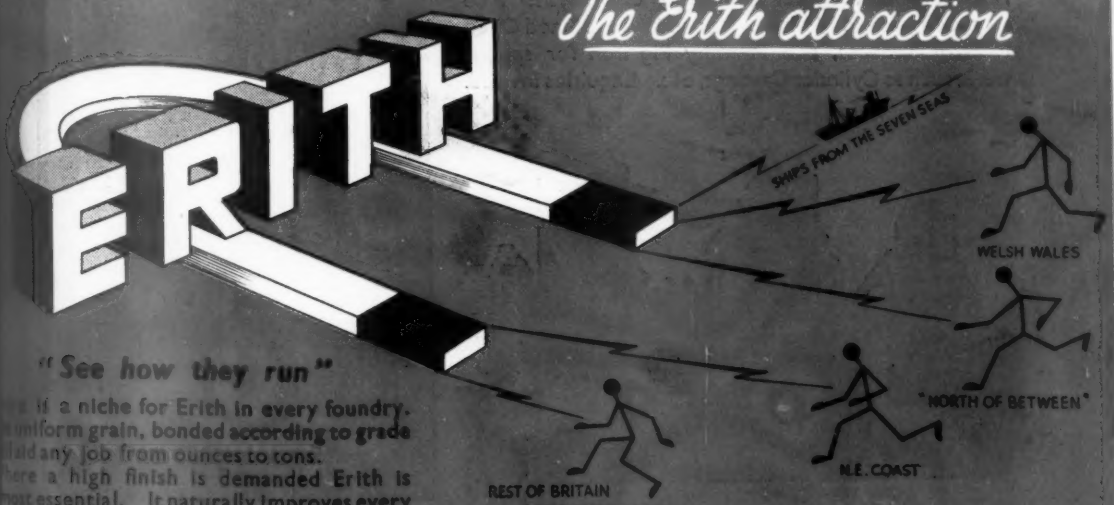
Single Copy 6d. By Post 8d
Annual Subscription, Home and Overseas, 21/- (Prepaid)

ITISH
OULDING
ACHINE Co. LTD
ERSHAM, KENT.

FLUXITOL for Perfect Castings or Ingots
CUPOLINE for Furnace and Cupola Repairs
EFFICIENT service. with consultation
ROBSON REFRACTORIES LIMITED
47, Coniscliffe Road, Darlington
'Phone: 2441 'Grams: Cupoline

MANSFIELD MOULDING SAND
PULVERISED READY FOR USE IF REQUIRED
ALBION (Mansfield) SAND CO.
Prop.: THOS. W. WARD LTD. Head Office: Albion Works, SHEFFIELD.
Telephones: Sheffield 26311 (15 lines) Mansfield 371.

The Erith attraction



"See how they run"

... a niche for Erith in every foundry. ... uniform grain, bonded according to grade ... laid any job from ounces to tons. ... here a high finish is demanded Erith is ... most essential. It naturally improves every ... it touches.

...ARKETED IN FOUR GRADES OF LOAM ...ND WHITE SILICA FOR OIL CORE WORK

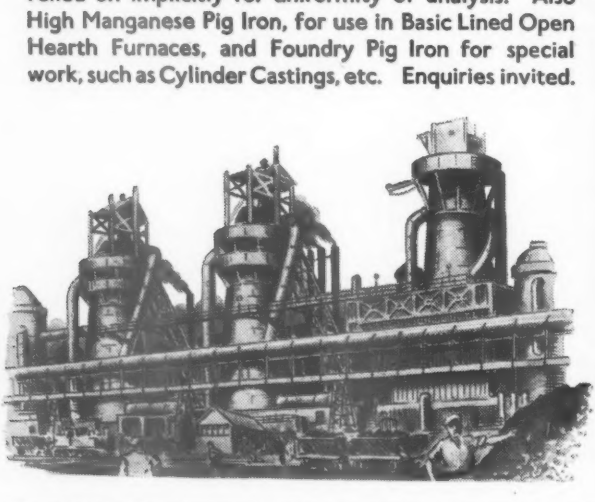
SOLE PROPRIETORS:
J. PARISH & CO.
Telephone: Erith 2056
Telegrams: Parish, Erith
LOAM QUARRIES
ERITH, KENT

TEISEN
ENAMELLING MUFFLES.
KING'S NORTON, BIRMINGHAM

Used by many leading foundries
DISTRIBOND
the PROVEN British substitute for Bentonite
DISTRICT CHEMICAL CO., LTD. 1-19, New Oxford St., London, W.C.1

CONSETT
High Grade Hematite
PIG IRON

Manufactured to customers' requirements. Can be relied on implicitly for uniformity of analysis. Also High Manganese Pig Iron, for use in Basic Lined Open Hearth Furnaces, and Foundry Pig Iron for special work, such as Cylinder Castings, etc. Enquiries invited.



Also best Quality

FOUNDRY COKE
SILICA BRICKS AND SHAPES
FIREBRICKS & FIRECLAY

MANUFACTURED UNDER SCIENTIFIC SUPERVISION TO CUSTOMERS' DESIGNS AND SPECIFICATIONS.

CONSETT IRON COMPANY LIMITED

TELEPHONE: CONSETT 341 (10 lines)
TELEGRAMS: STEEL, 'PHONE, CONSETT

CONSETT, Co. DURHAM

FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 71 Thursday, December 23, 1943 No. 1427

Clearing the Way

The interest in technical education consequent upon the publication of the "White Paper" has caused the appropriate institutes to turn their attention to the subject of a "national" examination for metallurgists. The definition of a metallurgist is easy enough—one who extracts metals from ores and supervises their subsequent working into articles of commerce—but popular opinion is apt mentally to restrict the application of the term to persons versed in the narrower science of metallurgical chemistry. We, personally, have always regarded a steelworks manager, or a foundry executive as being more truly a metallurgist than the head of a works' laboratory, because their activities are those covered by the definition. This question of nomenclature only becomes of importance when dealing with Government departments. In Scotland and the North of England, metallurgical chemists and metallurgists are usually quite often called the works' chemist or more simply "chemist." This has caused more difficulties with the Ministry of Labour and National Service than would have been the case if they had been classified more correctly. Again, the records of the Patent Office will show that we have from time to time changed the title of our profession from metallurgical chemist, and metallurgist to metallurgical engineer to correspond with the nature of the alleged invention. The tendency by metallurgical chemists to discard the title of chemist is due no doubt to a desire to eradicate any notion in the social circle in which he moves that for his living he stands behind a counter and retails Bile Beans. The tendency for the travelled metallurgist to add a hyphenated engineer, is due to the fact that on the Continent engineering is a profession whilst a metallurgist is a tradesman.

If there is to be a national certificate granted to the metallurgist, the question arises as to what subject should be the basis for the examination. Our definition indicates that it should be of a practical bias, covering a wide field. If there be any intense specialisation, then the metallurgist enters another profession—that is, he may be designated a metallographist, a physicist, a ceramist, a chemist, a mineralogist, or an hyphenated engineer. Thus the truth is, a metallurgist is a technician possessing a knowledge ranging from much to little of trade technique, inorganic and organic chemistry, physics, mathematics, mechanical and electrical engineering, commercial and patent law, labour management, languages, costing, refractories, and may be a few other subjects, usually including some knowledge of the techniques practised by the users of his products. A knowledge of a wide selection of these is obviously necessary if the metallurgist is successfully to "extract metals from their ores and supervise the working into articles of commerce" under the diverse conditions which modern industry demands. It is obvious that the training of this professional Jack of All Trades is difficult, let alone the establishment of his worth by examination. As his duties usually demand specialisation, coupled with a wide general knowledge, the choice of subjects upon which he should be examined should be equally wide. A Sheffield trained metallurgist engaged on the manufacture of magnet, stainless and other special steels knows virtually nothing about P.M.G., Alpax, and Elektron—so familiar to his non-ferrous colleague. Remove the very specialised knowledge of workers in these fields and residual technology is just pure science and general knowledge. Thus, if there is to be a national certificate, let it be so organised that the specialists in all branches have an equal chance, or restrict the questions to catering for a more or less elementary character covering the widest possible field, for such is the nature of the knowledge required by the Jack of All Trades.

Contents

Clearing the Way, 321.—A New Method of Income Tax Deductions Explained, 322.—Correspondence, 322.—Quality of Castings Begins in the Foundry, 323.—A.F.A. 1944 Foundry Congress, 328.—Anodic Films on Aluminium Alloy Parts of German Aircraft, 329.—Manganese Alloy No. 772, 330.—Metal Spraying Foundry Patterns, 330.—Metals in U.S. War Production, 330.—Cast Iron Grids *v.* Steel Rods, 331.—Arc Furnace Roofs, 331.—Foundry Trades Equipment and Supplies Association, 332.—Workers' Clothing Coupons, 332.—News in Brief, 332.—Obituary, 334.—New Patents, 334.

THE NEW METHOD OF INCOME TAX DEDUCTIONS EXPLAINED

THE INCOME TAX (EMPLOYMENTS) ACT, 1943

The Income Tax (Employments) Acts, 1943, provides the necessary machinery for the new scheme of deductions of current income tax from earnings, and although this Act at present only applies to what are officially known as "weekly wage earners" (*i.e.*, manual workers), and to employments up to £600 per annum earnings, the new system by another Act will apply from the same date (first pay day after April 15, 1944) to everyone under Schedule E irrespective of rate of earnings.

Before coming to the new scheme, it might be useful to note that for persons assessed yearly under Schedule E, at present, deductions for tax on earnings for year ending April 5, 1943, commenced November 1, 1943, therefore by the date when the new scheme starts only five months' instalments for this tax will have been paid, leaving seven-twelfths of tax still outstanding; as there could not very well be two deductions simultaneously, these seven months instalments will be washed out, leaving no back tax payable on this account. For "weekly wage earners" assessed half-yearly, deductions of tax for half-year ending April 5, 1943, started August 1, 1943, and deductions for half-year ending October 5, 1943, were to have commenced February 1, 1944, but there will be no assessment for the half-year ending October 5, 1943, deductions for February and March, 1944, to be the same as for the period August 1, 1943, onwards; if any adjustment is required this will be subsequently made. Thus it will be seen that for earnings April 6, 1943, to April 5, 1944, the only tax payments will be two months' instalments (February and March, 1944), leaving ten-twelfths of tax outstanding, which tax, however, will, similarly as above, be washed off the slate.

By the new scheme each taxpayer will come under a code, each code representing the relevant personal allowances (*e.g.*, each person £80, wife £60, each child £50, and so forth), and expenses (*e.g.*, tools, special travelling expenses, etc.). There are tax tables applying to each code, which will show tax payable according to wages, and in these the earned income allowance (one-tenth) is taken into account, and also the fact that the tax poundage up to the first £165 of taxable income is 6s. 6d., 10s. afterwards. Furthermore, the procedure of the personal allowances to apply at each tax deduction is given consideration, the deductions being in accordance with the "cumulative tax" procedure, which is the fundamental principle of the scheme, thus one fifty-second is taken into account for the first week, two fifty-seconds for the second, three fifty-seconds for the third week, and so on up to the fifty-second week. The employer for the first week takes the amount of the wages, turns to the appropriate tax tables, and gets the tax deduction for the particular code (the employer is notified of the code number for each employee); this is easy, but for succeeding weeks a little more reckoning is necessary. For the second week he aggregates the first and second week's wages and then gets the cumulative tax for the aggregated amount from the tables; afterwards the tax deduction for the first week is taken off, leaving the amount of tax to be deducted for the second week. This procedure follows on similarly to the end of the year; therefore a sum of addition and subtraction each pay day. Thus, the employer does not compute the tax payable, the tables give him that information, and to just take the wages and deduct the personal allowances known to the taxpayer will not always return the same amount of tax as the tax tables (the employer, however, cannot depart from the tables), but at the end of the year the tax payable will usually balance, as if the tax were paid yearly. In some instances slight adjustment will be necessary. This will arise because the codes cover ranges of allowances and expenses (thus code 36 applies to reliefs £201 to £205), and there is also such things as late claims for allowances, special reliefs (*e.g.*, life assurance allowance), and so on. Where an under payment of tax is shown an adjustment of the coding for the next year will follow, and this ordinarily will apply to an overpayment, although in these cases the taxpayer if he so desires can obtain immediate repayment.

A notice of assessment will be issued to each taxpayer at the year's end showing the tax payable and the tax deducted (with information given as to how any difference is to be dealt with); for this purpose the usual annual return of income and claim for allowances will be made by each taxpayer. If wages fall or cease temporarily, the amount of the tax deducted up to a particular date may be more than the cumulative tax system calls for; in these cases a repayment by the employer is to be made forthwith, and for this purpose he can use any tax money he may have in hand. Ordinarily, the tax deducted is to be paid to the collector monthly, or for small amounts quarterly.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

SPLIT BRASS PLATES

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The foundry at which I am employed is experiencing considerable trouble in casting flat brass plates 12 in. long x 7 in. wide x ¼ in. thick. The trouble is caused by their inability to overcome the characteristic split in the centre section of the plate which reveals itself on drilling.

In view of the fact that many castings hitherto made in gun metal or aluminium are now called for in brass, I would like to make enquiries through the medium of your columns, or alternately would suggest that an article describing ways of overcoming this difficulty would be of general interest.

Yours, etc.,

"SOUTHERN MOULDER."

December 9, 1943.

SAVE MORE PAPER

QUALITY OF CASTINGS BEGINS IN THE FOUNDRY

By WILLIAM G. REICHERT

Every factor in foundry practice determines the final quality of castings and merits the closest consideration and control

Quality, dependability and uniformity are the factors which must be considered if any foundry is to survive as a post-war enterprise. Many foundrymen consider that the quality of their castings begins and ends in the foundry, but only a cursory examination will show that it must necessarily begin with the design. There are many who would believe that a specification of chemical and physical properties of the metal is the ultimate goal in casting quality. This is very far from correct, and is the basis upon which this paper is written. However, the fact must not be overlooked that a rigid process control for the specification of materials and the product and its adaptability to certain uses has advanced the industry tremendously.

The production of castings is not a simple matter and a high degree of technical skill must be exercised in the control of the operations. In order to benefit the casting industry and to produce quality castings foundrymen must—(1) Improve the quality at no additional cost; (2) maintain the quality at no increased cost; (3) develop new applications for castings; (4) develop new alloys or metals for specific jobs, and (5) establish dependability of castings by proper methods of controlling the uniformity through the entire process from the raw material state to the finished product.

There are a number of factors which control the quality of the castings and, of course, in this short description only mention can be made of many of these items. The quality of the castings will depend in a large measure on:—(1) Design; (2) pattern; (3) gating and risering; (4) melting operations; (5) moulding and core operations; (6) cleaning and finishing; (7) management.

Design Factors

Practically every manufacturing process has its limitations and foundrymen should not accept work which is improperly designed and which they know beforehand cannot be produced satisfactorily on a commercial basis. However, some slight change in design may help. Very often it is better to make two castings and fasten them together.

There are, however, a number of well-recognised basic principles which will help the design of the casting. Very often merely discussing a design with the engineers, and, with their co-operation, will change a casting from a high cost rather impractical combination of bosses, ribs, and flanges to a more simple design of casting which the foundry can readily produce at a lower cost and with the assurance that the resulting part will meet every requirement.

The amount of draft required depends upon the shape and size of the casting, method of production and whether moulded by hand or machine. Machine moulding will require a minimum draft.

Parting lines should be made as even as possible to facilitate moulding. Avoid irregular and multiple parting lines because they tend toward dimensional irregularities, increase moulding and cleaning cost and offer a poor surface quality.

Locating points and jig spots are important items frequently neglected until the castings are made.

Section uniformity—An attempt should be made to design all sections in a casting with a uniform thickness—abrupt changes in section are not desirable. A uniform section equalises the rate of solidification and simplifies both the gating and the feeding. Non-uniform solidification sets up internal strains and causes shrinkage cavities, cracks, and reduces strength. Wherever uniform thicknesses are impossible the changes in a section should be made with a gradual taper rather than abruptly.

Bosses and lugs are common to all castings, and if not properly designed frequently lead to foundry difficulties. When used they should conform to the thickness of the adjacent section as closely as possible. This may be accomplished by a riser acting as a feed for the boss or a metal chill may be placed against the face of the boss. Such a chill tends to equalise the rate of solidification and make it more or less identical with the thin section of the casting. Bosses are frequently cored in order to maintain uniformity of the metal and thereby simplify foundry practice.

Adequate fillets at all intersections will reduce scrap due to shrinkage and cracks, but we must also remember that the fillets should not be so large as to increase metal sections and affect a non-uniform section,

Square corners are to be avoided wherever possible. A sharp corner may readily develop a minute check that will extend into a crack, particularly in the vicinity of the gates where the metal cools last. In cases of this kind, losses due to cracks will be greatly lessened if the corners are slightly rounded off. Sharp corners at adjoining sections are sources of defects, and, if possible, should be eliminated. When a design of a cast steel structure becomes very complicated or intricate, it is suggested that it be broken up into parts, so that they may be cast separately and then assembled by welding or other means.

Ribs are used primarily to reinforce sections of the

* A Paper presented on behalf of the Metropolitan Chapter of the American Foundrymen's Association to the London Branch of the Institute of British Foundrymen. Dr. A. B. Everest read the Paper and Mr. R. B. Templeton presided.

The Quality of Castings

casting. The rib sections should have a fair relation to the casting section. Thin ribs because of rapid cooling may set up casting strains and cracks. Staggered ribs are usually designed to avoid intersections. In designing sections that join in an "X" section, it is suggested that two of the arms be offset considerably.

Metal inserts should be knurled or grooved to insure mechanical bond, and sufficient metal must be provided around such inserts to eliminate cracks during solidification.

Machine surfaces wherever possible should be cast in the drag since there is less opportunity of these surfaces containing defects, such as shrinkage and blow-holes. The best design casting is the one in which all members progressively increase in thickness to one central location where a riser can be placed. In the final analysis let us always remember that the cheapest design is the one which represents the least difficulties and risks in manufacture, and this is particularly true in the production of quality and especially pressure castings. The final solution lies in a close co-operation between the designer and the foundryman and a better understanding of mutual problems.

Pattern and Pattern Equipment Factor

The method by which the pattern is made will often ultimately determine the quality of the castings. As a criterion the casting is never better than the pattern from which it is made. The false economy of makeshift and almost unusable patterns, the use of poor material, or so-called economical design of the pattern are all realised by most foundry executives as being regular happenings. In repetition work this does not generally occur because the ultimate value of the order permits a reasonable pattern cost. Here it is realised that uniformity, quality and rate of production give an adequate return.

However, vast quantities of castings must be made which are not of a repetitive character—yet very often higher standards are demanded from these jobbing castings; for example, steam pressure castings, turbine castings, and simllar castings. Accuracy of shape, perfect soundness, the precise placement of all cores, are matters of infinite importance, and yet the design may alter considerably from order to order. When the significance of all these points is realised, one would imagine that patterns for such parts would be of the very best.

Moulding Equipment and Methods

It must constantly be borne in mind that a pattern is used solely to make moulds and finally produce the castings. Consequently, mould design should be considered before the pattern is made. In addition to forming the mould cavity, the pattern must be provided with gates and oftentimes risers to compensate for solidification contraction. Consequently, the location of the risers, and the facility of attaching, as well as removing these, must be considered.

The pattern allowances required to produce the casting of proper size and shape, depend partly on casting design, shrinkage and contraction characteristics of the metal involved, and many other factors. These factors cannot always be computed precisely, and a process of trial and error must be undertaken so that pattern dimensions can be adjusted to give castings of dimensions required by drawings. These points are mentioned to emphasise that whole-hearted co-operation between the designer, patternmaker and the foundryman is essential from the conception of the idea to the delivery of the casting as a finished product.

Pattern Equipment Classification

In general, patterns may be classified as follows:—(1) Single, loose, wood or metal patterns; (2) gated, wood or metal patterns; (3) metal match-plate patterns; (4) wood, cope and drag patterns; (5) metal, cope and drag patterns; and (6) special pattern equipment.

Hand moulding is the most expensive method of manufacturing castings and, therefore, patterns should not be classified for this type of moulding unless production schedules or difficulties in moulding necessitate this step.

Single, loose wood patterns are relatively cheap, but should be used only for a very limited production. Such patterns warp easily and are damaged readily in handling. They are adaptable especially where an experimental piece of equipment which is subject to development is being built and where only one or two castings are required from a pattern. Certain types of jobs, even though ordered in small quantities, will yield more satisfactory castings, and a final lower cost, if the patterns are mounted; this is particularly true with intricate jobs where dimensions are critical.

Fundamentals to be Considered

No detailed discussion on pattern equipment, production and maintenance can be attempted in this short article; however, there are some fundamentals which must be considered. Every foundry should vest authority in some experienced man to make decisions on the most efficient and economical machines and equipment that will be used on new jobs before setting the cost. If the foundry be sufficiently large, a department devoted exclusively to this important planning work should be maintained where every individual job is analysed before attempting to quote casting prices.

In any case, foundry personnel in charge of production castings should confer with the patternmaker to determine:—(1) The best method of manufacturing the pattern; (2) the foundry requirements for making the pattern; and (3) the best method of moulding to produce quality castings at lowest cost.

All new pattern equipment prior to release for production should be checked and no quantity should be made until the castings are approved by the customer. All patterns should be inspected and kept in proper repair. Poor patterns cause poor moulds and slow up production. Rapping plates should be placed on

all loose patterns wherever practical. The moulders should not be allowed to use dowel points for rapping.

All patterns in use should be cleaned daily, and additionally:—(1) Points of gates and risers should be clearly marked on all patterns; (2) all patterns should be checked each time before production and, on long-running or repetitive jobs, checked periodically; (3) all patterns should be properly marked according to standard pattern colours; and (4) well-kept patterns prevent undesirable mould patching and improve the quality of the castings.

Moulding and Sand Practices

Properly controlled moulding sand is essential in the construction of castings. It must be recognised that a casting is only as sound as the moulds will allow. There is little to be gained by casting controlled metal into a sand mould where the resulting properties of the castings are seriously impaired by imperfections. Defective casting will not only nullify the qualities and properties of the metal, but will effect a lack of confidence on the part of the design engineer.

The economic value which can be placed in the proper use and control of moulding sand may be expressed both as a monetary saving and as an improvement in the surface quality of saleability of the casting.

General Requirements of Moulding Sand

The general requirements of moulding sand follow:

(1) Sand should be sufficiently mouldable to conform to the shape of the pattern with a reasonable amount of ramming. Some types of moulding machines require a sand that will compact considerably more than others and may even require a different type of sand, depending on the method of ramming.

(2) The sand should possess sufficient green strength to prevent drops, particularly in the handling of the mould, and sufficient strength at elevated temperatures to prevent cutting and washing. Since both the green and hot strength depend to some extent upon the moisture content of the sand, great care should attend the tempering operations.

(3) A good moulding sand must have sufficient permeability, when moderately rammed, to allow the air in the mould as well as the steam and gases generated when the mould is filled with iron to escape rapidly, thereby preventing the scabbing of the mould and the blowing of the iron.

(4) The sand grains must be sufficiently fine to yield a satisfactory mould surface if the castings are required to be smooth and clean without the addition of graphite, or other materials added to the mould interface.

(5) The sands must be made sufficiently refractory so that they will not melt or sinter badly when exposed to molten metal temperatures in the ordinary foundry practice.

(6) The sand should be sufficiently collapsible after the metal is cast to allow for relative ease in cleaning operations and prevent hot tears and cracks. In general, since the choice of a sand with respect to fineness is determined both by permeability requirements and by casting surface requirements, better results in the majority of cases may be obtained by the proper selection of simple sands of a uniform distribution than by mixtures of coarse and fine sand. If sufficient coarse sand is used in the mixture to ensure permeability, it will be this coarse constituent that determines the surface character of the mould, and it will very definitely determine the surface character of the casting.

(7) Excessive expansion, contraction, hot strength or a combination of these properties at elevated temperatures may cause defective castings. Therefore, the sand must possess satisfactory properties at atmospheric as well as at elevated temperatures.

(8) The face of the mould must be designed so that it prevents penetration and that it peels well from the casting. Since many cores are made from moulding sand, these should shake out rather easily if cleaning costs are not to be excessive and quality castings are to be produced.

Moulding Sand Mixtures

While there are definite rules for compounding moulding sand mixtures the success or failure of a particular mix usually is not definitely known until it is tried in the foundry, this is due to the many variables that exist when considering the field of moulding sand mixtures. A mixture that may produce perfect castings in one shop may result in complete failure in another if not properly handled and applied. Therefore, each problem must be studied individually before any recommendations can be offered.

This difference in the results of the same mixture may be caused by different characteristics of the grain, differences in mineral composition of the grain, differences in the composition of the clay minerals, type of moulding machines, method of ramming, physical properties of the sand, binders, and probably many other variables.

Properties of Sand at Elevated Temperatures

A study of the effects and the ingredients added to moulding sands at elevated temperatures is extremely important in order to obtain fundamental data on the properties of moulding sand at casting temperatures. The importance of this subject can best be understood when two sand mixtures are considered having the same physical properties at atmospheric temperature, yet extreme differences at elevated temperatures, for example, sand mix "A" and sand mix "B" used for the manufacture of alloy steel casting.

The physical properties of the facing sand of both mixtures are as follows:

	A	B
Moisture	4·5	4·9
Flowability	78	80
Green permeability	60	64
Dry permeability	122	116
Green compression strength ..	7·2	6·5

The Quality of Castings

According to the test data given, both of the above sands should react the same. However, "A" produced satisfactory castings free from hot tears, while "B" did not. The "A" mixture was compounded with bentonite, silica sand, silica flour, cereal binder and wood flour, whilst mixture "B" was compounded with bentonite, silica sand, oil and silica flour. From all indications of atmospheric temperature tests "B" should be more collapsible than "A" because of its lower strength. However, when the two sands were subjected to elevated temperature tests differences were apparent. Mixture "A" had a lower expansion value and a much lower hot strength value than "B."

In the final analysis, the condition of the sand in the mould is the real criterion of its fitness, and to correlate casting defects with sand control figures the reaction of moulding sands and the mould at elevated temperatures should be known.

Precautionary Measures

A number of precautionary measures for moulding and core operators follows:—(1) Thoroughly investigate defects and definitely determine the cause before changing sand mixture. (2) All gates, runners and runner bars should be made in facing sand. Cores are preferred. Do not concentrate blows in ramming procedure. (3) Ninety per cent. of the dirt in a mould is gathered between runner box and mould cavity. Runners should be deeper than ingates and should run past ingates to a dirt trap. (4) Reduce facing sand as much as possible—1 in. is as effective as a foot, but do not reduce facing at the expense of good castings. (5) Keep facing sands separate. Mixing cores and fine facing will often result in a poor surface finish causing scabs, buckles, and dirt inclusions. (6) Use swab as little as possible. (7) A hot mould should be cooled before assembling. (8) An increased amount of slicking may cause scabs and buckets. (9) Blacking wash should be tested and maintained at a definite Baumé or specific gravity. (10) Torn mould if not pressed back immediately should be removed. This causes scabs, air dry in crack of tear.

Cores

(1) It pays to standardise all core-making operations: (*a*) measure the sand; (*b*) measure the binder, and (*c*) mix for exactly the right length of time. (2) Study oven conditions. Use a temperature recorder on the core oven. A core oven does not dry at the same rate and time throughout all parts. (3) Do not rap coreboxes more than is necessary or the cores will not retain shape—the corebox will also last longer. (4) Do not use rods too near the surface. (5) Test cores to see that they are firm and the vents clear before passing to the moulders. (6) Be sure all core vents have free exit through flask.

Problems Not Related to Sand

Often local conditions are responsible for inferior or scrap castings, and while these defects are often attributed to sand, the real cause may be iron melting temperatures, unbalanced chemical elements, rapid iron solidification through delayed pouring, flask equipment, pattern design, gating, venting, mechanical difficulties, or a multitude of other causes, including the personnel of the foundry, and the purely personal conditions of the men.

To illustrate, on one occasion considerable drop defects occurred in a heavy casting foundry where 90 lbs. of air was recommended for the jolters. This pressure was maintained at the machine until the valves were opened, then dropped rapidly due to the lack of a sufficient reserve supply. It was considered that weak sand was the cause of this defect. However, the defect was eliminated after the installation of an additional air accumulator to maintain the proper pressure at the machine.

In one centrifugal casting foundry defects caused by drops occurred in a small pocket of the pattern, and this was attributed to the sand. Moulding practices as well as the source of the sand supply were changed, but the correction was not found until it was observed that both of these defects were confined to moulds made on one of the three machines used. This focused attention on that particular machine, and although operations appeared normal, the guide plates were found worn. This allowed the pattern plate to shift and cause the drop during the draw operation. This was due to the uneven release of the pattern from the mould. The replacement of the worn guide plates eliminated this defect.

Moulding machines located on loose or weak foundations may cause serious difficulties which are frequently attributed to sand. In one foundry the excessive wear of flask pins caused sticker defects originally attributed to the sand. Improperly fastened pattern plates as well as broken cope bars may cause drops, while broken flasks have been found to cause cracked moulds. Therefore records of sand testing and control will aid materially and act as an effective guide to the answer of many casting defects and foundry problems.

Gating and Risering

In the light of all present knowledge internal shrinkage and sponginess are still with us. They have been a major foundry problem since the first castings were made, and are still the cause of thousands of rejects every day. Of first importance is the production of sound castings. High strength iron mixtures and the use of alloys play a very valuable part in the industry, but the fact must be recognised that these foundry tools are worthless until a solid casting can be produced. The first requirement is a design to which the principles of "controlled directional solidification" may be applied. If this be not possible with the design as originally produced, a few slight changes may be required.

Controlled Directional Solidification

When metals solidify they contract, and it should be recognised that cooling starts at the surface and progresses towards the centre. When this phenomena happens a shrinkage cavity occurs equivalent to the

contraction of the metal. Controlled directional solidification is successful only when certain principles of casting design are adopted. These principles stress the importance of feeding smaller sections through heavier ones. Only when the temperature gradients within the metal and the mould are such that the feed heads are the last portions of the casting to solidify, and thus can furnish liquid metal to fill the voids formed during solidification, can a sound casting be produced.

To prevent isolated hot spots in the casting it should be designed so that the shrinkage can move progressively from all members of the casting to the riser. From this standpoint the best designed casting is the one in which all members progressively increase in thickness to one central location where a riser can be placed. If demands make it impossible to permit this gradual and progressive tapering of all sections to a common point, it is necessary for the foundrymen to provide additional reservoirs of metal to supply those sections which are cut off from the central riser.

Hot Tears—Cause and Elimination

Undoubtedly there are a number of factors affecting the formation of hot tears in steel castings, such as:—(1) Contraction stresses: (*a*) caused by mould resistance, and (*b*) caused by uncontrolled directional cooling; (2) pipes or cavities, and (3) the physical properties of the steel: (*a*) strength at solidification temperatures, and (*b*) fluidity.

Moulding resistance is very conducive to the formation of hot tears. The fact that some sands are considered non-collapsible at elevated temperatures and resist the contraction of the steel is not the entire story. The mould hardness and the quantity of sand around the casting also are important. Cores are especially responsible for mould resistance, iron core bars, and reinforcing bars offer a resistance that is difficult to overcome. On the other hand, castings that crack in dry sand may not crack in green sand, due to the fact that their collapsibility is greater in green sand. In many cases stresses are concentrated by the method to which the metal solidifies, and the concentration of these stresses are caused by uncontrolled directional solidification. If no thought is given to the rate of solidification of the various sections. the metal will solidify so that a thin section which has totally solidified will pull away from the heavier section, which is in the critical solidification range and susceptible to crack formation.

Pipes and small cavities are factors in the formation of hot tears, as they become centres of stress concentration. Pipes and cavities often form at the last point of solidification of a section, and are usually the weakest point of the casting. It is well known that all types of cavities are points of stress centralisation, and thus the two factors of metal weakness and stress concentration produce hot tears and cracks. Abrupt changes in sections are centres for stress centralisation, and if there be a lack of control directional cooling, pipes and cracks will form. The importance of obtaining fluidity has been emphasised because a smaller percentage of defects will be found in castings poured with a more fluid metal. The greater fluidity allows for better controlled directional solidification and the possibility of filling the cracks. If a crack should form in a casting already solidified and the crack extend to liquid metal, then the greater fluidity of the steel, the more opportunity there is for the crack to become completely filled.

Measures Employed to Eliminate Hot Tears

Amongst these are:—(1) Collapsible moulds and cores. (2) The use of chills at the proper sections. (3) The application of ribs and wedges at certain changes of cross section. The application of ribs do not eliminate the contraction stresses, they merely tend to eliminate these stresses from centralising at one point and rupturing the casting. The strength added to the surface skin by the presence of ribs acts to transfer converging stresses over a wide area. They have been used rather extensively, and their function is to solidify earlier than the sections they adjoin and act as a bond to prevent cracking; (4) the use of thermal non-conductive moulding materials; (5) casting in pre-heated moulds; (6) pouring from elevated temperatures, and (7) casting design.

In some foundries all castings large or small are poured on the dull side. If the metal is hot it is chilled by adding scrap to the ladle. However, when the iron in one foundry was increased in temperature and poured hot for pressure castings, the machine shop losses from leakage, shrink, dirt and spongy metal dropped so suddenly that it served as conclusive proof that hot pouring was essential to pressure-type castings. In fact, the improvement in the machine shop was so marked that hot pouring was required.

Dull pouring, that is, pouring near the freezing temperature, brings about a quick freezing of the skin of the casting, by heating up the cold mould, but does not provide the necessary temperature difference between metal and mould to establish a steel temperature gradient when freezing is approached. Thus the interior of the casting cools relatively slowly. Pouring temperatures which are too low, even if sufficiently high to avoid cold shuts, may not permit risers to perform their primary function of feeding the casting or to carry off slag, dirt and dross.

Casting temperatures which are too high, apart from increasing liquid shrinkage and quite apart from other disadvantages, reduce the rate of solidification, because the excess heat of the metal is communicated to the mould before the freezing point of the metal is reached. The resulting very gradual solidification produces not only a very coarse structure, but allows the occurrence of serious segregation, therefore controlled pouring temperatures are desirable in the manufacture of quality castings.

Composition and Fluidity

Shrinkage also varies with the composition or the solidification range of the metal. Carbon and silicon are important factors, and any considerable change in either of these will so alter the shrinkage that modification in gates and feeders became necessary to insure complete soundness in the casting. The

The Quality of Castings

composition of the metal must be in balance, and an iron thrown out of balance due either to a high silicon or carbon content will produce an open porous structure, particularly in heavy sections. The solidification range of the metal, the temperature at which the metal is poured, as well as the surface area and size of the gates, affect shrinkage. Very often foundrymen claim that a low temperature iron will prevent internal shrinkage, and on the other hand others state that a high temperature will prevent internal shrinkage. It is possible that both of these statements are correct, but apparently other important controlling conditions have not been stated.

Where the shrinkage section is far removed from the ingate, iron of a low temperature will eliminate shrinkage because the metal is near the solidification point. Let it also be remembered that by reducing the area of the gate, one can pour iron so that it will be dull and near its solidification point by the time it reaches the section of high shrinkage.

Another method of eliminating shrinkage is to place this section in question near a heavy gate. Hot iron entering the heavy gate will often eliminate this shrinkage because the gate will then act as a feeding riser.

Rate of Pouring

Another factor that is of prime importance is the effect of pouring rate. Theoretically it is possible to pour a casting without risers if the rate of pouring and temperature of the metal is correct. This "rate of pour" is a critical value, and deviations from the exact rate will result in one of two conditions—if the rate be too high, shrinkage will be found, and, if the rate be too low, the outside of the casting will show laps or cold shuts and other defects, such as scabs and pockmarks. If the rate of pouring is kept as low as is practical, the riser may be diminished and soundness improved. However this does have certain disadvantages.

The scabbing of the cope can be remedied by:—(1) Faster pouring; (2) a more thorough nailing of the cope surface; (3) an increased use of crabs in the cope, and (4) a change in the sand mixture.

Chills and Brackets

If heavy sections are located in inaccessible places where risers cannot function the use of chills must be resorted to. These may be used either externally or internally. A chill will equalise the rate of cooling in the different sections and produce a more uniform freezing rate in the casting, thereby preventing porosity. An external chill shaped to the contour of the casting accelerates the cooling and solidification of that part of the casting affected. An internal chill, usually a piece of rolled metal of a composition similar to that of the casting to be poured, is placed in relatively heavy sections of the mould, so that the liquid steel completely surrounds it and in so doing accelerates the cooling and the solidification of the metal at that point. Very often chills are placed in cores to equalise the cooling rate on a heavy section.

If external chills be too small they do not balance the cooling, while if too large they are apt to cause small surface cracks. Experience and good judgment are necessary in selecting the correct size of chill to maintain this balance. Let it be remembered, too, that chills must be thoroughly clean to prevent undesirable chemical reaction with the molten steel. If moulds containing chills are not poured reasonably soon after closing, the chills are apt to condense moisture and become rusty. When this occurs the liquid steel will not lie quietly against the chills, and defective castings may be produced.

A common expedient to strengthen sections susceptible to concentrated contraction stresses are triangular brackets of relatively light metal sections joining the flange in the body and spaced equally around the casting. These brackets solidify early and have much greater strength than the more plastic metal in the sections affected by a cooling lag during this critical period. The removal of these brackets is an expensive cleaning operation, and the result detracts from the general appearance of the product.

(*To be continued.*)

A.F.A. 1944 FOUNDRY CONGRESS

EXTENSIVE PROGRAMME PLANNED

The American foundry industry will meet in Buffalo, N.Y., next April 25-28, for the Third War Production Foundry Congress, to discuss problems of control, production and quality. This 48th annual meeting of the American Foundrymen's Association will be held in conjunction with a Foundry Show of materials, equipment and supplies for foundry use.

The technical features of the Congress will be of wide and timely interest, with developments and practices applying to current problems in the production of cast metals for war use thoroughly covered. A number of "off the record" discussions of special war production problems are being arranged. Separate programmes will deal with each of the cast metals. Several symposia are planned, one on malleable iron specialising in heading and gating, and one for steel men covering shop practices, melting practice, heat-treatment and sand control. A third symposium of current interest is that on centrifugal casting developments.

The annual Foundation Lecture of the Association, initiated in 1943, will be presented by Dr. H. W. Gillett, Chief Technical Advisor, Battelle Memorial Institute. Dr. Gillett has chosen "Cupola Raw Materials" as his subject. Manganese bronze castings work due to the increasing use of alloy castings in meeting wartime demand will be stressed at brass and bronze meetings. Sessions of the aluminium and magnesium division will be of outstanding interest, as developments in these metals have been greatly accelerated in the past two years.

ANODIC FILMS ON ALUMINIUM ALLOY PARTS OF GERMAN AIRCRAFT*

By the STAFF OF METALLURGY DIVISION, ROYAL AIRCRAFT ESTABLISHMENT

Samples of anodically-treated aluminium alloy parts have been taken from several German aircraft, chiefly from the airframes. These have been examined for type and nature of the anodic films. In all, nineteen parts have been examined. The names of the castings, the aircraft from which they were taken, the appearance of the anodic films, and the corresponding type of British material, are indicated in Table I. Scratch tests and bend tests showed that the films were adherent, hard and brittle. The film on the cock body was very hard.

Chemical Tests.—Chemical tests were made on samples of the films after removal of the films by scraping. Sulphate was detected in all the films except that on the cock body. Chromium was detected in all the yellow films, but not in the buff-coloured film on the cock body. It is evident that all the films except that on the cock body had been produced in sulphuric acid baths, and that the yellow films had been sealed in dichromate solutions.

Observations on Film Thickness

Observations on film thickness were made by removal of the films by chemical means and by microscopic examination of transverse sections. A boiling solution of phosphoric and chromic acids was used, as recommended by J. D. Edwards (A.S.T.M. Preprint No. 19, 1940), since sealed films are not readily removed by cathodic treatment in hot chromic acid solution. The thickness of the films was calculated from the loss in weight on stripping. In the calculation of film thickness the density of the film was assumed to be 2.8. It is known, however, that the density of anodic films on aluminium alloys varies with the conditions during formation of the film, etc., and that the values obtained in this way vary by ± 25 per cent. from the actual values of film thickness. Transverse sections of the samples were prepared, and the anodic films were examined microscopically. The examination revealed no unusual feature. The microscopical method of observing the thickness of anodic films on aluminium is generally considered to be the best.

Comments and Conclusions

The anodic film on the cock body appeared not to have been sealed. The film was very hard, was 15 microns thick, and appeared to have been produced by the "Eloxal GX" process, *i.e.*, by D.C. treatment in an oxalic acid bath. As the plug (steel) of the cock seats directly upon the light alloy body, a hard anodic film on the latter should be of advantage in this application. Part of the cock body was cleaned and retreated in an 8 per cent. oxalic acid bath at 60 volts, 18 to 20 deg. C., 60 mins. The new film resembled the original one, but was 22 microns thick. The anodic films on the other items examined had all been produced on sulphuric acid electrolytes. It is therefore most probable that the D.C. sulphuric process known in Germany as the "Eloxal G.S." process had been used. Most of these films had been sealed by treatment in dichromate solutions to provide increased efficiency of protection. The thicknesses of the films, 5 to 15 microns, are not unusual for films produced by this method. The depth of colour of the yellow films appeared to be roughly proportional to the thickness of the films. The films on the external surfaces of the oxygen bottles had not been sealed by dichromate treatment, but had been dyed blue. The film on the gun mounting ring casting was of dark grey colour, due to the aluminium alloy containing a high percentage of silicon.

TABLE I.—*Anodic films taken from German aircraft testings.*

Sample No.	7	15	19
Aircraft:	JU 88A4	JU 88A4	HE 115BB
Date of capture ..	23/3/42	18/1/43	—
Component ..	Mounting ring nose gun	Pipe coupling	Cock body
Material	Al alloy (9 per cent. Si 0·5 per cent. Cu)	Al alloy (2 per cent. Mg.)	Al alloy (4·85 per cent., Mg. 1·11 per cent. Si)
Appearance of film	Rough, dark grey	Pale yellow	Buff
Thickness in microns by chemical method	10	—	—
By microscopical method	15	6	15

Anodic treatment of aluminium aircraft parts in Germany has been described in an article in "Dornier Post." The conditions of operation are 15 to 20 amp. per sq. ft., 11 to 22 volts, 16 to 24 deg. C., and sulphate of aluminium content of bath not greater than 45 grammes per litre. Hot potassium dichromate solution (90 to 95 deg. C.) is used to seal the films.

* Extracted from a Report issued by the Ministry of Aircraft Production.

ACCORDING TO THE SWEDISH PAPER, "Affarsvarlden," bomb damage in Germany has resulted in an increased supply of scrap to the German iron and steel industry.

American Metallurgical Scene—15

MANGANESE ALLOY No. 772

Developed by the W. M. Chace Company, manganese alloy No. 772 is one of a series of alloys made from electrolytic manganese of high purity. It is characterised by a somewhat unusual combination of physical properties, and is the subject of patent rights (U.S. Nos. 2,202,012, 2,234,748, 2,263,572, 2,294,389). The nominal composition of the alloy, says "Nickel Bulletin," is manganese 72, copper 18, nickel 10 per cent., with impurities controlled to a minimum. The physical properties claimed are shown in Table I.

TABLE I.—*Properties of Alloy No. 772.*

Electrical resistivity—	
ohms per circular mil-foot at 80 deg. F.	1,050
ohms per square mil-foot at 80 deg. F.	825
microhms per cm.³ at 25 deg. C. ..	175
Temperature coefficient of resistance per deg. C. (25 deg.–150 deg. C.)	0·000141
Temperature coefficient of expansion per deg. C. (25 deg.–150 deg. C.)	$27·5 \times 10^{-6}$
Thermal conductivity—	
cal. per sec. per cm.³ per deg. C. per cm...	0·02
Emissivity—	
As rolled	26 per cent.
Polished	20 per cent.
Specific heat—15 deg. to 35 deg. C.—cal. per gram per deg. C.	0·126
Density—grams per cm.³	7·21
Weight—lb. per cubic in.	0·26
Vibration damping constant	2·3 per cent.
Vickers hardness—50 per cent. cold reduction	220
Modulus of elasticity	18×10^6
*Tensile strength (p.s.i.)	115,000
(Tons per sq. in.) (approx.)	50
*Yield stress—0·1 per cent. set p.s.i. ..	95,000
(Tons per sq. in.) (approx.)	42
*Proportional limit (p.s.i.)	50,000
(Tons per sq. in.) (approx.)	22
*Elongation in 2 in.	6·5 per cent.

* Curves in the original give values for the properties marked over the range 0 deg.–600 deg. F. (0 deg.–315 deg. C.).

The alloy is non-magnetic, and the values given in Table I indicate that, in addition to high strength and ductility, it has a high temperature-coefficient of expansion, high electrical resistivity, high damping capacity, and low thermal conductivity. This combination of qualities renders the material suitable for low-temperature resistor applications and for use in electrical apparatus, where parts located in a varying magnetic field may be rendered immune from eddy-current losses if made from this high-resistance alloy.

The high temperature-coefficient of expansion of the manganese alloy has made possible the development of a new type of thermostatic bimetal, giving improved thermal deflection and greater strain energy. The low thermal conductivity suggests the suitability of the material for metal inserts in moulded plastics, frames or supports for electrical heating elements, electrical appliances and utensil handles, brackets and similar uses. In addition, its combination of strength and damping capacity has useful application in assemblies in which rubber or plastics cannot be incorporated for the purpose of reducing vibration. It is especially useful in eliminating sustained resonance of metallic members due to intermittent shock.

METAL SPRAYING FOUNDRY PATTERNS

For wearproofing wooden core boxes and foundry patterns against the abrasive action of sand by spraying the surfaces with a light coating of metal, an Alloy-Sprayer, an electrically-heated and thermostatically-controlled metal melting pot, with a gun handle for air pressure control, has been devised in America. If the wood surface is soft, or open grained, the metal can be sprayed directly on to the finished wood surface without special preparation. If the wood is hard and close-grained, a coating of shellac is applied and the spraying is done when the shellac is "tacky." In either case, the thickness of the coating is usually 0.002 to about 0.005 in. After the coating is sprayed, it is cooled and sanded.

METALS IN U.S. WAR PRODUCTION

Despite the fact that American industry increased its production of strategic materials in 1942 from 38 per cent. for alloy steel to 700 per cent. for chromite, the needs of military production this year have required much greater quantities of almost all critical materials, stated Mr. Donald Nelson recently. The United States war programme set early this year amounted to $106,000,000,000—80 per cent. more than the $59,000,000,000 total for last year. Only about one-quarter of total steel consumption at the end of 1941, was in direct military use, it declares. But at the end of 1942 direct military use and export to the Allies accounted for over two-thirds of steel consumption. The same situation applied to other materials with direct military consumption of aluminium last year totalling 588,500 short tons, or 168 per cent. above that for 1941; in 1941 about two-thirds of military consumption of aluminium was for aircraft; last year it jumped to nearly 80 per cent. Exports rose 366 per cent. last year, production of chromite rose by almost 700 per cent. during the year; magnesium by 220 per cent.; aluminium by 77 per cent.; alloy steel by 38 per cent.; molybdenum, tungsten and vanadium by 40 per cent.

CAST IRON GRIDS *v.* STEEL RODS

In a Paper entitled "Making Cores for the Steel Casting," presented by MR. S. W. BRINSON and MR. J. A. DUMA at a meeting of the American Foundrymen's Association, the authors express a preference for cast-iron grids. This problem of supporting the core is such that having an iron foundry in the same plant is an aid. It is much easier to design and make a cast-iron arbour, just like a bridge truss, than it would be to employ steel rods, although steel rods sometimes are used in conjunction with cast iron arbours and in small cores. On the other hand, it is necessary to guard against making the arbour too massive or heavy, as it may crack the castings due to its rigidity.

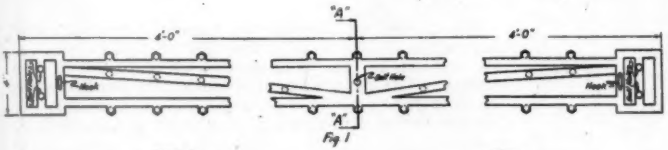


Fig 1

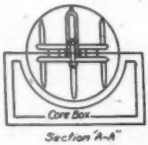


Fig. 2.

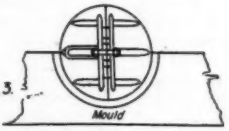


Fig. 3.

FIG. 1.—PLAN VIEW OF ARBOUR FOR 6-IN. BY 8-FT. CORE. FIG. 2.—SECTION VIEW OF CORE AND ARBOUR. FIG. 3.—CORE AND ARBOUR IN MOULD.

At the Norfolk Navy Yard the practice is not to make a cast-iron arbour, with prongs or toes which extend close to the core surface to support the sand, square on the end. This would have an effect of crushing a block of dried sand between the casting and the arbour. If, for example, the prong or toe had a 1-in. square section, then it would have to crush a block of dried sand with 1 sq. in. of surface. The authors' practice is to bring these prongs or toes to a sharp edge like the point of a chisel which more easily breaks up the core.

The prickers running at right angles to the plane of the arbour are made a little on the long side. The coremaker can then very easily fit the arbour to the box by breaking off the excess length with a hammer and a short piece of pipe. The arbours are never blasted or cleaned and are at off times stored in the weather. Arbours are also stamped. The result is a rough surface which will better hold the sand and make clay washing seldom necessary.

Supporting a Long Core

The question of long cores supported only at the ends, and of the elimination of chaplets in pressure castings is often discussed. Recently, it was necessary to make a high-pressure pipe casting in steel about 6-in. inside diameter and 7 ft. long, and it was desired to make this casting without using a chaplet. The difficulties the problem presented can be easily realised, especially with the use of loose rods or bars.

The procedure was as follows: The core was made in halves and the arbour for each half designed as shown in Fig. 1. One-half of the core was made and rolled out on a flat plate. The other half was then rammed, the first half picked up by means of hooks, cast in the arbour and placed on top of the half of the core still in the box. The two halves were then bolted together and the entire core lifted, placed on a bed of sand and dried. Any holes left for bolting were necessarily back filled. Fig. 1 shows a side, end and plan view of arbour for half core. Fig. 2 shows the placing of the cores together, and Fig. 3 shows how the core was located in the mould.

There are other advantages of the use of cast-iron arbours over the use of rods. For hollow cylindrical or half cylindrical cores, where the hollow centre of the core is accessible from outside of the mould, the cast-iron arbour can be more easily broken to permit the core to collapse. The cast-iron core, being heavier, tends to reduce the buoyancy of the core when the mould is poured, and cleaning out is more easily accomplished during fettling. From the above it can be seen that where possible to use cast-iron arbours every job becomes a tailor-made job, cut to fit the conditions.

ARC FURNACE ROOFS

Report No. 411 of the steelworks committee of the Verein deutscher Eisenhüttenleute, by H. MULLER, reproduced in "Stahl und Eisen" of March 18 last, recounts practical experience with arc-furnace roofs constructed from unit bricks in which metallic cooling rings are embedded. These unit bricks were of a standard size and were machine pressed instead of hand-rammed, the main object being to save labour. Steel production in arc furnaces has increased to such a degree in Germany that silica consumption has passed beyond the capacity of the quarries, and has led investigations to be carried out on a special construction of furnace roof with these standard bricks to avoid the furnaces being too long out of commission for reservicing. The standard-brick roof is claimed to have much reduced the consumption of silica and to have eased the call on the quarries. The roof using these unit bricks is of special design and can be lined with either standard bricks or rammed, the cooling rings which are of metal being suspended from a small bridge which does not rest on the bricks, but affords some support for them.

FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION

The annual meeting was held on December 16 at the National Liberal Club, London, S.W.1. Mr. G. E. France presided and welcomed Mr. Daniel Sharpe, the President of the Institute of British Foundrymen.

After reading the notice calling the meeting, the honorary secretary submitted the annual report, which in substance stated that the membership of the Association, numbering 20, has remained unchanged during the year. The financial position remains substantially unchanged. No new wartime activities have been found for the Association, whose main business remains dormant. Only one meeting, the Annual General Meeting, was held. At that meeting the honorary secretary reported that he had been released from military duties and was consequently able to resume his honorary office. He was duly reinstated. The work of the secretariat, in the person of Miss Cox, recently acting secretary, has chiefly been in connection with the Dextrine Control, and has been, as before, on a considerable scale. This Control, established at the request of the Ministry of Food, is under the auspices of the Association, but is not part and parcel of that body, as it embraces some 200 firms, who pay a special small levy to cover the expenses of printing and postages, but contribute nothing for rent or services. No contribution from any Government department has been received.

Mr. G. E. France was re-elected President and Mr. E. J. Penstone and Mr. D. Cherry Paterson Vice-Presidents.

WORKERS' CLOTHING COUPONS

THE "INDUSTRIAL TEN"

Employers in the foundry trade have up to February 26 to apply for the ten additional clothing coupons which are again to be made available to a wide range of manual workers. Details of the workers eligible and of the method of application and issue are set out in leaflet I.T. 44, which employers must make accessible to all workers. This extra ration, usually known as the "Industrial Ten," is similar to that given out in the 1942-43 rationing period and the categories of workers eligible are mainly the same as then. Part-time workers in eligible occupations will be able to apply, if they work 22 hours a week or more, and supervisory workers if they are exposed to exceptional conditions.

Coupons will be issued as before through local offices of the Ministry of Labour and National Service to employers for distribution to their workers. Special arrangements are being made for certain industries in which there are some workers with exceptionally heavy needs. Details of these are being notified to the employers and workers concerned through employers' organisations and trade unions.

NEWS IN BRIEF

MR. EDWIN MALLALIEU, 19, Grangethorpe Drive, Burnage, carrying on business at Jubilee Street, Manchester, brassfounder, is paying a supplemental dividend of 7½d. in the £.

THE NATIONAL ARBITRATION TRIBUNAL has issued an award in favour of the claim by the Engineering Joint Trades Movement that pieceworkers should be guaranteed a minimum payment of the timeworkers' base wage plus their national bonus.

A WOLVERHAMPTON SECTION of the Institution of Production Engineers, with Mr. E. W. Hancock, who is prominently connected with the firm of Rubery, Owen & Company, Limited, of Darlaston, as its first chairman, was launched at an inaugural meeting held recently.

MR. E. BEVIN, Minister of Labour, has received a deputation of the local authorities of Lanarkshire on the subject of the development of industry in the county. The deputation afterwards met the Secretary of State for Scotland, and discussed arrangements for advancing the cause of new industries in Lanarkshire.

THE DIRECTORS of the Weardale Lead Company, Limited, propose to reduce the issued capital from £97,919 to £51,040 10s. This is to be effected by repaying 2s. per £1 share, being paid-up capital in excess of the company's requirements, writing down property and plant by £39,167 12s. and reducing the nominal amount of the issued shares from £1 to 10s. Upon the scheme becoming effective the 2,082 £1 unissued shares will be split into two 10s. shares and the capital restored to the original amount of £100,000 by the creation of 97,919 10s. shares. The directors point out that the reduction would greatly facilitate the possibility of a resumption of dividend payments.

AMERICAN STEEL ingot and castings production during September was the highest for any 30-day month in history, the average tonnage produced per week exceeding average weekly production in all preceding months, the American Iron and Steel Institute reports. New furnaces coming into production are primarily responsible for the increased output. Total September production was 7,488,978 net tons of ingots and steel for castings, an average of 1,749,761 tons per week. In March of this year, a 31-day month, production was 7,670,187 tons, an average of 1,731,419 tons per week. September output compares with 7,562,125 tons in August, which was at the average weekly rate of 1,707,026 tons. In September, 1942, production totalled 7,057,519 tons, an average of 1,648,953 tons per week. During September the steel industry operated at an average of 100.4 per cent. of capacity, highest since the outbreak of the war. In August, the rate was 97.9 per cent., and in September, 1942, it was 96.4 per cent. of available capacity. In March this year, peak month for total production to date, operations were at exactly 100 per cent. of current capacity. Total output in the nine months was 66,294,032 net tons, as against 63,966,055 tons in the parallel period of last year.

Save Fuel
in your CUPOLAS
by using
STANTON
SAND-LESS
Machine Cast
PIG IRON
THE STANTON IRONWORKS COMPANY
LIMITED NEAR NOTTINGHAM

OBITUARY

MR. EDWARD FISHER, manager, John Bedford & Sons, Limited, Sheffield, has died at the age of 76.

MR. ERNEST EDWARD CUTLER, managing director of Samuel Cutler & Sons, Limited, constructional engineers, and a director of C. & W. Walker, Limited, engineers, died recently.

MR. ALBERT RIGBY, senior director of John Rigby & Sons, Limited, Parkhouse Wire Mills, Low Moor, Bradford, died recently after a brief illness. He had been actively engaged with the firm for more than 50 years.

CAPT. PETER GOODISON TYZACK, of Belsize Road, Fulwood, Sheffield, who was Midlands and West of England representative for W. Tyzack, Sons & Turner, Limited, of Sheffield, is now known to have been killed in Sicily. He was previously reported missing. Capt. Tyzack was 30 years of age.

MR. JOSEPH COLLEY, who for 35 years was the chief engineer and manager of the steel department at the Springvale furnaces, Bilston, then belonging to Alfred Hickman, Limited, and now known as the Alfred Hickman branch of Stewarts and Lloyds, Limited, died on December 11, in his 91st year.

MR. JAMES CAIG has died in Manchester, at the age of 63. Well known in the tool steel trade, he was associated with the production and sales of tool and high-speed steels at Vickers Works, Sheffield, from June, 1897, until some ten or eleven years ago, when he went to the English Steel Corporation's works at Openshaw, Manchester.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

557,439 ABBEY, A. (Bliss Company, E. W.). Presses especially for shaping sheet metal.

557,454 ENGINEERING & RESEARCH CORPORATION. Curved structural members and method of manufacturing them.

557,484 BRASSERT & COMPANY, LIMITED, H. A., MILES, J., and NISSIM, R. Furnaces.

557,508 BRASSERT & COMPANY, LIMITED, H. A., MILES, J., and NISSIM, R. Furnaces.

557,538 BRASSERT & COMPANY, LIMITED, H. A., and NISSIM, R. Electric arc furnaces.

557,553 BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION, LIDDIARD, E. A. G., BAKER, W. A., and GLAISHER, W. H. Method of and apparatus for refining metals and alloys.

557,599 OUGHTIBRIDGE SILICA FIREBRICK COMPANY, LIMITED, and BROOKE, S. Furnace linings.

RECENT WILLS

MURRAY, P. B., of Dundee, engineer	£9,084
EGLIN, W. H., of Halifax, hardware manufacturer	£30,096
COATSWORTH, H. C., of Sunderland, managing director of the Wear Winch & Foundry Company, Limited	£18,522
LAMONT, J. H., of Corstorphine, Edinburgh, chairman of James H. Lamont & Company, Limited, engineers	£145,073

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Midland Brass Fittings Company, 21, Waterloo Street, Birmingham—£10,000.

Wilkins & Wilkins, Quay Side, Hamworthy—Engineers, etc. £2,000. C. W. M. and J. G. V. Wilkins.

S.A.R. (Steel), 19, Anyards Road, Cobham, Surrey—£2,000. H. G. F. Shoring and F. H. Whittingham.

Repton Engineering Company, 82, Tennant Street, Birmingham, 3—£1,000. E. Day and M. N. Madden.

Coseley Welding Company, Whitehouse Street, Coseley, Staffs—£1,000. C. W. and H. A. Hyde, and J. Webb.

Horsell Welding Company—£1,000. A. Tayler, Helanjo, Rosehill Avenue, Horsell, Woking, subscriber.

Steele & Cowlishaw, Cooper Street, Shelton, Stoke-on-Trent—Engineers. £50,000. G. Steele and L. Arrowsmith.

Repetition Steel Products, 39A, Stafford Road, Waddon, Croydon, Surrey—£2,000. L. O. Bellamy and M. H. Seigenberg.

Daniel & Sons & Company (Brassfounders), 78, Cross Lane, Great Horton, Bradford—£1,000. G., J. W., and R. E. Daniel.

Charles W. Ashby, Ibex House, Minories, London, E.C.3—Iron and steel merchants. £10,000. C. W. Ashby, J. W. Thain, and C. B. Hewitt.

L. E. Stubbs & Company, 2c, Well Street, Porthcawl, Glam.—Engineers, contractors, etc. £2,000. L. E. and E. Stubbs, and J. S. Flower.

Winstanley & Company (Kings Norton), Murdoch Works, Kings Norton, Birmingham—Engineers. £7,500. H. M. Winstanley and E. J. Kimberley.

Cowdrill Bros.—Metal stampers, spinners and turners, tool makers, etc. £2,000. A. J. and L. A. Cowdrill, 270, Farm Street, Hockley, Birmingham, 19.

R. Adair & Company, 38, Wood Lane, Shepherds Bush, London, W.12—Metal merchants. £20,000. R. Adair, S. H. Mallinson, A. J. Norrington and R. G. Spillett.

Howarth & Walter, Handel Street Foundry, Bradford—To acquire all or any of the assets of the business of ironfounders carried on by the Holehouse Furnace Company, Limited, at Handel Street Foundry, Listerhills, Bradford. £5,000. H. W. Howarth and R. Walter.

PERSONAL

MR. R. J. ALLEN, metal manufacturer, of Edgbaston, has been elected a member of the Birmingham City Council.

MR. H. R. HUMPHREYS has been elected a director of Cammell Laird & Company, Limited, Birkenhead, and appointed assistant to the managing director.

MR. J. P. ANDERSON, assistant engineering manager of Cammell Laird & Company, Limited, Birkenhead, has been appointed a local director of the company.

Over 100 years ago "Boulton Pennies", which contained about 97 per cent. copper, were added to malleable iron in the Birmingham district when "Specially good metal was required".

COPPER

The metal that is associated with all progress

From the dawn of civilisation there has never been an era in which copper has not contributed an important part to the welfare and progress of mankind. This is as true today as it was in the Bronze Age, but copper alloys and the applications of copper are now so numerous that a wise choice for each and every application is no easy matter.

If you have this difficulty or any other arising from the use of copper you should not hesitate to consult the Copper Development Association. The Association's advisory service is available to you free of charge.

COPPER DEVELOPMENT ASSOCIATION

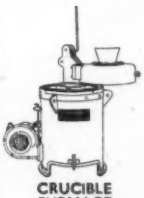
A non-trading organization maintained by the British Copper Industry to supply information and advice, free, to all users of copper.

Grand Buildings, Trafalgar Square, London, W.C.2
and 9 Bilton Road, Rugby
Telephone: only Rugby 2369 C12

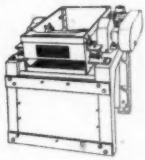
COMPACT, SELF-CONTAINED

SAVES TWO THIRDS OF FLOOR SPACE

Exceptionally Quick Mixing Times—



CRUCIBLE FURNACE



VIBRATORY SCREEN

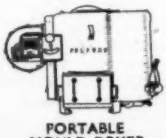
Note the small area occupied by the base of the "Polford" Core Sand Mixer. It is self-contained, the motor being built into the machine. With liquid Core Compounds, a batch may be mixed in 1½–2 minutes, and this unit will mix all Core Compounds, including semi-solids. Simple in design, fitted with screen for riddling sand as it is fed. Operates efficiently with minimum of friction. Low upkeep.

This Machine has proved excellent for mixing facing sands.

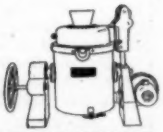
"POLFORD"

Core Sand Mixer

Patent Applied For



PORTABLE MOULD DRYER



TILTING FURNACE

Other **"POLFORD"** *Products*

THE HEATON FOUNDRY CO. LTD.

Makers of Foundry Equipment,

HEATON JUNCTION, NEWCASTLE UPON TYNE, 6.

COMPANY RESULTS

(Figures for previous year in brackets)

Carrier Engineering—Dividend of 25% (same).

Light Production—Interim dividend of 10% (same).

Wheesoe Foundry & Engineering—Interim dividend of 10% (same).

Beyer Peacock—Dividend on the 5½% first preference shares for the year to June 30, 1938.

Lake & Elliot—Final dividend of 15% on the ordinary shares, making 20% (same).

Sydney S. Bird & Sons—Dividend of 30%, less tax, for the year ended September 30 (same).

Shelvoke & Drewry—Profit, £77,674 (£114,802); taxes, £68,500 (£100,000); dividend of 10% (same); forward, £6,997 (£4,073).

Alexander Hall—Net profit, £4,903 (£4,552); depreciation, £4,083 (£3,558); ordinary dividend of 2½% (same); forward, £19,973 (£19,465).

Mitchell, Shackleton & Company—Profit to September 30 last, after depreciation and taxes, £33,105 (£30,480); final dividend of 7½%, making 12½% (same); forward, £48,472 (£42,367).

J. Brockhouse & Company—Trading profit to September 30 last, after E.P.T., N.D.C., and income-tax, £181,441 (£183,541); dividend of 20% (same) on the ordinary shares; forward, £139,298 (£101,439).

Bullers—Net profit to July 31 last, £23,984 (£27,956); debenture redemption, £3,638 (£3,465); pensions, £5,000 (same); preference dividend, £3,750 net (same); ordinary dividend of 7½% (same); forward, £26,577 (£20,828).

Cleveland Bridge & Engineering—Net profit to June 30 last, £14,883 (£17,060); preference dividend, £1,232 (same); ordinary dividend of 4½%, tax free, £13,153 (same); to general reserve, £2,000 (same); forward, £5,470 (£6,972).

Atlas Steel Foundry & Engineering—Profit for the year ended September 30, £34,064 (£31,510); depreciation, £4,881 (£5,000); interim dividend of 15%, £8,437 (same); final dividend of 17½% and a bonus of 10%, £15,469 (£3,478).

Hepworth & Grandage—Net trading profit to September 30, after depreciation and E.P.T., £74,250 (£67,445); income-tax, £20,871 (£21,187); war damage contribution, £2,858 (£3,856); dividend of 12½% (same), £25,625; reserve, £20,000 (same); forward, £14,246 (£12,150).

Thomas Blackburn & Sons—Trading profit for the year to June 30, £42,855 (£73,376); net profit, after taxation, depreciation, etc., £11,566 (£11,670); dividend on the preference shares for the year, less tax, £1,800; dividend on the ordinary shares of 7½% (same); to reserve, £5,000; forward, £2,917 (£3,026).

Stewarts and Lloyds of South Africa—Profit for year, including dividends on investments and after providing for taxation and charging debenture interest and depreciation, £200,636; to contingencies reserve, £75,000; debenture redemption reserve, £5,600; 20% dividend for year (same) on the ordinary shares, £82,000; forward, £87,768 (£85,232).

Butler Machine Tool—Profit to September 30 last, after allowing £8,000 (£15,000) for E.P.T., £59,185 (£59,473); brought in, £17,288 (£17,060); tax adjustments, £1,624 (£4,075); income-tax, £12,386 (£12,045); war damages, £1,011 (£1,445); obsolescence, £3,000 (£18,575); to general reserve, £13,425 (nil); ordinary dividend of 12½%; forward, £17,020.

William Asquith—Profit for the year to August 12 last, after charging depreciation, £97,498 (£132,934); taxation and contingencies, £75,000; interest on the non-cumulative redeemable funding certificates, less tax, £1,058; dividend of 5% (same) on the ordinary shares; to general reserve, £10,000; forward, after preference dividend, £26,196 (£23,419).

Cannon Iron Foundries—Net profit for the year to June 30, £105,267 (£78,584 for nine months); provision for taxation, including income-tax payable January 1, 1945, £67,763 (£47,064); war damage contribution, £728 (£811); net balance, £36,776 (£30,709); brought in, £11,841; final dividend on the ordinary shares of 5% (same), making 10% (same for nine months).

PARLIAMENTARY NOTES

Silicosis in Foundries and Metal Works

Certificates granted by the Silicosis Medical Board under the Various Industries (Silicosis) Scheme, 1931, in respect of workmen employed in processes in foundries and metal works covered by the scheme, were as follow in the last five years, according to information given by the Home Secretary:—

Dressing and fettling of steel castings: Certificates of total disablement or suspension on account of the disease: 1942, 20; 1941, 7; 1940, 7; 1939, 2; 1938, 4. Deaths certified to have been caused by the disease: 6 in 1942, 7 in 1941, 5 in 1940, 4 in 1939, and 2 in 1938.

Sandblasting of metal or articles of metal:—Certificates of total disablement or suspension on account of the disease: 1942, 3; 1941, 9; 1940, 5; 1939, 5; 1938, 9. Deaths certified to have been caused by the disease: 1942, 6; 1941, 5; 1940, 3; 1939, 4; 1938, 6.

Industrial Safety Boots

MR. DALTON said he was doing all that was possible to increase the output of safety boots. Production was limited by the labour and manufacturing capacity available, but it was running at between 500,000 and 600,000 a year.

DAVID BROWN & SONS (HUDDERSFIELD), LIMITED, in conjunction with the Directorate of Public Relations, Ministry of Supply, have just completed a successful exhibition at their main works, showing the products of the organisation. The exhibition was opened by H.R.H. the Princess Royal, and workers employed on the manufacture of gears and gear units, particularly those without a technical background, have welcomed the opportunity of seeing the application of many of their products. Opportunities were also afforded to a number of Technical Schools in the district to visit the exhibition.

Improve YOUR STEEL CASTINGS

ORDINARY SILICA PAINT

Note separation from water

Note permanent suspension in water

G.R. SILICA PAINT

G.R. SILICA PAINT

- **Avoids continual stirring by moulder.**
- **Increases refractory value of mould surface.**
- **Gives excellent skin to castings.**

ALMOST pure silica (97%), G.R. Silica Paint possesses high refractoriness—equivalent to Seger Cone 32 (1710° C.). It remains in permanent suspension in water and the moulder does not require continually to stir the slurry. In addition to increasing the refractory value of the mould surface it imparts a smooth finish and gives an excellent skin to the castings—especially if the mould facing is of Yorkshire Sand. Supplied in powder form for mixing with water to a slurry consistency. An addition of 2% of some organic binder — such as Molasses, Dextrine, etc.—is an advantage, as it hardens the mould surface and facilitates handling.

General Refractories Ltd

Head Office: Genefax House, Sheffield, 10. Telephone: 31113 (6 lines)

FIREBRICKS · BASIC BRICKS · ACID-RESISTING MATERIALS · PLASTICS · INSULATION · SILICA BRICKS · SILLIMANITE · SANDS · CEMENTS

Raw Material Markets

IRON AND STEEL

Seasonal influences exercise little effect on the production of iron and steel. Immediate effort is concentrated on the completion of orders due for delivery before the end of the year, and although arrears are not likely to be heavy, the pressure of work in hand will restrict holiday stoppages. A very large percentage of the output is going directly into use for Government purposes, and most insistent of all are the unceasing calls for shipbuilding material, which are expected to expand still further as the days begin to lengthen. Some of the consuming departments, the foundry trade among them, are not as busy as they were, and among these it may be possible to close down for a limited period to give the workers a holiday and effect necessary repairs.

Business in pig-iron has taken a quieter turn. For some time past the demand for foundry and forge iron has tended to fall short of production, and more recently a similar position has developed in regard to low and medium phosphorus and refined irons. Of these latter there is not a big surplus, and this may possibly be absorbed when consumers are ready to take up their licensed tonnages for January. The output of basic iron seems to be approximately balanced by consumption, and if hematite is still described as scarce, the makers under official direction are able to provide the requisite tonnages for essential purposes. The blast furnaces have good stocks of coke in hand, and are comfortably situated for ore, limestone, etc. The foundries, likewise, have no complaint to make as regards raw material supplies, though good cast-iron scrap might be more plentiful than it is at the moment.

The engineering and allied foundries, taken as a whole, are still busy, and are absorbing a substantial tonnage of pig-iron, ferro-alloys, and steel and cast-iron scrap. The position is different in the light-castings trade. There can be no hope of a renewed flow of business to the light-castings makers until the authorities show a greater willingness to allot labour and material to the satisfaction of civilian needs than they evince at present. The national interest in this, the fifth, year of the war must, of course, dictate policy in all such matters, but perhaps the time when production of domestic articles may be permitted is not now so far off. Lord Woolton, in his first speech as Minister of Reconstruction in the House of Lords, said that the Ministers of Production and Labour were already devoting their attention to the means to be adopted in reducing the volume of munitions production so that, industry by industry, factory by factory, and locality by locality, civil production might be resumed as Service demands declined. The light-castings trade depends for a large part of its activity on the building industry, and it is unlikely that building will start again on any scale until the war is finally won; but there is a lot of replacement work to which the foundries could turn their attention were they permitted to do so. The establishments are available and the pig-iron is there in plenty. Presumably the labour situation is the governing factor.

Steel ingot production is maintained at the highest possible level. Production of special and alloy steels has been brought up to the level of the heavy requirements of the aircraft and armaments industries, and steel makers are also regularly providing the very substantial tonnages of billets and sheet bars which are needed by the re-rollers to implement their commitments. There seems little prospect of any improvement in the call for heavy joists and sections, but the strain on the plate and light section mills is unremitting, and careful allocation of supplies is necessary.

NON-FERROUS METALS

The non-ferrous metal markets present few new features. Trading activities are hedged about by official regulations and restrictions. Prices are fixed, and metal can only be acquired on production of the necessary authority from the Control. There is a certain amount of "free" trading in scrap, owing to the fact that prices have in a few instances fallen below the official maxima, but even here activities are limited in many respects. The gratifying feature is the relative plentitude of most metals. Copper, lead and zinc are all in good supply, there is sufficient tin about to meet really essential needs, and aluminium production covers the requirements of aircraft manufacturers and other important users. Though consumption of the non-ferrous metals is a little lower now than it was even a few months back, total requirements are still very large indeed, and it is satisfactory to record that they are being so well met in the fifth year of a world war.

Alex. Findlay & Co. Ltd.
Structural Engineers, **Motherwell, Scotland**
Head Office: MOTHERWELL, N.B. *London Office:* 52/4, HIGH HOLBORN, W.C.1
Telegrams: { FINDLAY, MOTHERWELL. FINDLA, PHONE, LONDON. A.B.C. CODE 4th & 5th Editions.
STEEL BRIDGEWORK
BUILDINGS · ROOFS
GIRDERS · ETC.
Steel Pithead Frames
Steel Wagon Underframes
Speciality: **Stamped Steel Floor Troughing**

ABRASIVE WHEELS

for High and Normal Speeds . . .

HIGH SPEED ELECTRICALLY DRIVEN DRY GRINDERS
IN STANDARD SIZES

WET and DRY GRINDERS
TOOL GRINDERS etc.

LUKE & SPENCER, LTD.

BROADHEATH **ALTRINCHAM**

Telephone : Altrincham 3281-3282. *Telegrams : Emery, Altrincham.* *Code : ABC, 5th & 6th Editions.*

There's no Casting-away money when you use STERNOCORE

Whether Oil, Cream or Compound, the high efficiency gives better permeability, quicker drying, accurate cores, low objectionable gas content, and therefore, faster and cheaper production.

HIGHER PERMEABILITY

QUICKER DRYING

LOW GAS EVOLUTION

LOWER TRUE COST

REDUCED OBJECTIONABLE FUMES

STERNOL LTD., FINSBURY SQUARE, LONDON, E.C.2.

All Enquiries should be addressed to: **Industrial Specialities, Dept. 34.**

Also at BRADFORD AND GLASGOW

Temporary Telephone: Kelvin 3871-2-3-4-5
Telegrams: "Sternoline, Phone, London"

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, December 22, 1943

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.: Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s. South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(*Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.*)

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43. Briquettes, £30 per ton.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6½d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅜ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 15s.

Tin.—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

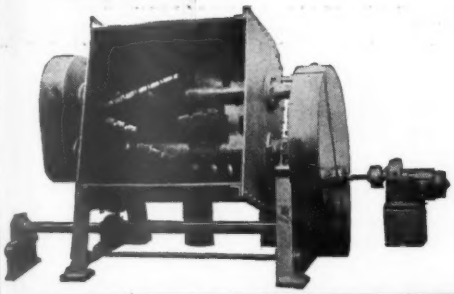
Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11½d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10⅞d.; wire, 10½d.; rolled metal, 10½d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15½d. per lb.; brazed tubes, 15½d.; wire, 10d.

Phosphor Bronze.—Strip, 13½d. per lb.; sheets to 10 w.g., 14½d.; wire, 16d.; rods, 16d.; tubes, 21½d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

DO all mixers really mix?



. . . or is it just a glorified stir? For real mixing means the bringing of the various ingredients into a true homogeneous batch, with the proportions of the materials correctly maintained throughout. Comparison of ordinary mixer blades of fanciful shapes with the scientifically designed intermeshing blades of the Beken Duplex Mixer explains the difference. The work is done between the blades of the Beken Duplex Mixer and *not* between the blades and the pan . . .

A foundryman writes: "I am pleased to state I am convinced the Beken Duplex machine is very suitable for mixing oil sand. The results prove that the mixing action is very thorough."

BEKEN DUPLEX MIXERS do

Sole Distributors: LAVINO (LONDON) LTD. 103 KINGSWAY, LONDON, W.C.2

Sole Makers: E. HUNT & CO., LTD. RIPPLE ROAD, BARKING, ESSEX

Telephone: Chancery 6137 (3 lines)

How are YOU tackling this labour problem?

Loading, unloading and handling of loose or bulk materials without mechanical aid involves a serious waste of labour—to say nothing of lost time for wagons. This practical Loader is tackling the problem—saving a substantial part of previous time and labour—for a large number of different industries handling such materials as Coal, Coke, Sand, Pig Iron, Scrap, etc. How are YOU tackling this vital problem?

Why not put your material where it is wanted in the minimum time with the minimum labour? Write us now for details.

PARKER Portable Belt LOADERS

FREDERICK PARKER LTD. (Extension 12), VIADUCT WORKS, CATHERINE ST. LEICESTER
'Phone: Leicester 61273 (4 lines)

London Office: (Extension 12), TALBOT HOUSE, ARUNDEL STREET, STRAND, W.C.2. 'Phone: 4239 & 2739 Temple Bar, London

FOUNDRY TRADE JOURNAL
EST. 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL
VOL. 71. No. 1427. DECEMBER 23, 1943
Registered at the G.P.O. as a Newspaper. Offices: 49, Wellington Street, Strand, London, W.C.2
[Single Copy 6d. By Post 8d. Annual Subscription, Home and Overseas, 21/- (Prepaid)

Cutting, Grinding, Filing and Polishing

MORRISFLEX Flexible Shaft Equipment is ideal for grinding, sanding and cleaning all kinds of metal. The attachments for this purpose are of the highest efficiency.
For cleaning and buffing. MORREX Rotary wire brushes and re-fill sections are supplied in a variety of shapes and sizes, also MORRISFLEX polishing mops and felts and felt cones.
For cutting and filing components of aluminium, Elektron, non-ferrous alloys and ferrous metals, REX rotary files and cutters in over 100 different shapes are available.
MORRISFLEX machines are supplied in overhead suspension, bench and floor types.

WRITE FOR COMPLETE LISTS

Morrisflex

On Air Ministry, Admiralty, and War Office Lists

B. O. MORRIS LTD., SHIRLEY, BIRMINGHAM
'Phone Shirley 1237 'Grams: Morrisflex, Birmingham

Flexible Shaft Equipme